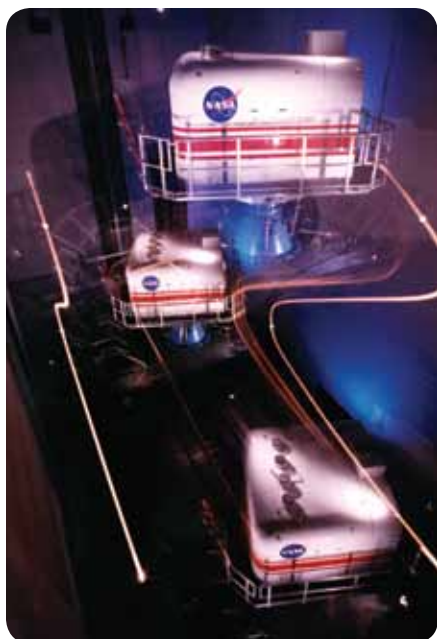NASA's Strategic Capabilities Assets Program

NASA AMES RESEARCH CENTER
VERTICAL MOTION SIMULATOR

Time-lapse image of the Vertical Motion Simulator

Fixed-base lab with two cockpit cabs

Cockpit cab on the simulator beam

The Vertical Motion Simulator (VMS) facility houses the world's largest high-fidelity motion-based simulation system, as well as a suite of associated simulation capabilities. This facility provides scientists and engineers with exceptional tools to explore, define, and solve issues in both vehicle design and mission operations, and it aids the research community in generating fast, cost-effective solutions.

The motion system is situated in a 110-foot tower and has a specially designed large-amplitude system that is unique in the world, moving as much as 60 feet vertically and 40 feet horizontally. This is key to high-fidelity simulation that, along with other sensory cues, makes the VMS unsurpassed at simulating aerospace vehicles throughout the flight envelope, including the critical phases of landing and takeoff. Two fixed-base labs are available for simulations and for preparing cockpits destined for the motion base.

The facility can be connected to other simulators via High Level Architecture for real-time distributed simulations. This capability enhances the realism of simulation scenarios and allows collaborative teams from across the country to work together to create the best solutions.

FACILITY BENEFITS

- Reduces program risk by providing a safe, yet realistic, environment for engineering research and development
- Allows collaborative research teams to iterate design steps in an integrated simulation environment
- Proprietary research procedures in place for protection of data confidentiality
- Remote research capability via virtual laboratory software
- Provides the highest-fidelity motion simulation in a ground-based facility
- Customizable cockpits provide a virtually unlimited range of physical configurations
- Adaptable simulation architecture allows testing custom software and hardware components in the real-time environment

FACILITY APPLICATIONS

- Develop, test, and refine new and existing vehicle concepts pertaining to handling qualities issues; aerodynamics systems; and guidance, navigation, and control
- Simulates a diverse array of aerospace and ground vehicles, including fixed- and rotary-wing aircraft, spacecraft, and a variety of surface vehicles
- Perform accident investigations
- Accommodate both NASA and external programs (e.g., industry, DOD, university)

NOMINAL OPERATIONAL MOTION LIMITS*

Axis	Displacement	Velocity	Acceleration
Vertical	±22 (ft)	15 (ft/s)	22 (ft/s²)
Lateral	±15 (ft)	8 (ft/s)	13 (ft/s²)
Longitudinal	±3 (ft)	4 (ft/s)	10 (ft/s²)
Roll	±14 (deg)	40 (deg/s)	115 (deg/s²)
Pitch	±14 (deg)	40 (deg/s)	115 (deg/s²)
Yaw	±20 (deg)	46 (deg/s)	115 (deg/s²)

*Maximum cockpit weight on beam: 15,000 lb

CUSTOMIZABLE COCKPIT FEATURES

- Multiple EPX 5000 image generation systems; 18 channels
- Collimated and direct-projection displays of out-the-window views
- Head-up displays
- Helmet-mounted displays; head-tracker capability
- Night-vision capability
- Glass cockpits
- Full suite of inceptors (standard and custom)
- Seat shakers
- Large inventory of very high-fidelity digital/hydraulic control loaders

DATA COLLECTION CAPABILITY

- Time-series data; 1,300 variables simultaneously
- Strip chart recorders
- Digital video and audio capture; in-cockpit cameras

CONTACT INFORMATION

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